

THE GENUS *METOPINA* (DIPTERA: PHORIDAE) FROM CRETACEOUS AND TERTIARY AMBERS

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Abstract.—Six specimens of the genus *Metopina* are reported from the late Oligocene amber of Chiapas, Mexico, the lower Miocene amber of the Dominican Republic, and with one of the specimens, *Metopina goeleti*, n. sp., the oldest known phorid, from the late Cretaceous amber of New Jersey. Details of the morphology and distribution are discussed with respect to living members of the genus. Species distinctions between the specimens in the Oligomiocene ambers are not apparent. Taxonomic placement of the Sciadoceridae previously described from Cretaceous amber of Canada is discussed, and it is hypothesized that the Phoridae s.s. appeared much earlier than the late Cretaceous.

While sorting and identifying Diptera in ambers recently acquired by the American Museum, the distinctive genus *Metopina* Macquart was discovered in pieces from Chiapas, Mexico and the Dominican Republic. The finding was made more significant by a specimen in a piece of amber from the late Cretaceous of New Jersey, in which there are about a dozen arthropods, including the oldest known bee, *Trigona prisca* (Michener and Grimaldi, 1988). The geology of the New Jersey fossil resins is discussed elsewhere (Grimaldi et al., 1989). Not only does this extend the geological record of the Phoridae, but it provides a record ranging from the present and through the Tertiary to the Mesozoic, which is more complete than for any other group of phorids. Strangely enough, *Metopina* is unknown from the well-studied, huge deposits of Baltic amber. Due to the small size of these phorids, it is quite likely that any specimens of them in this amber have been overlooked by earlier workers. *Metopina* also might be rare in most ambers because of their flower-visiting habits.

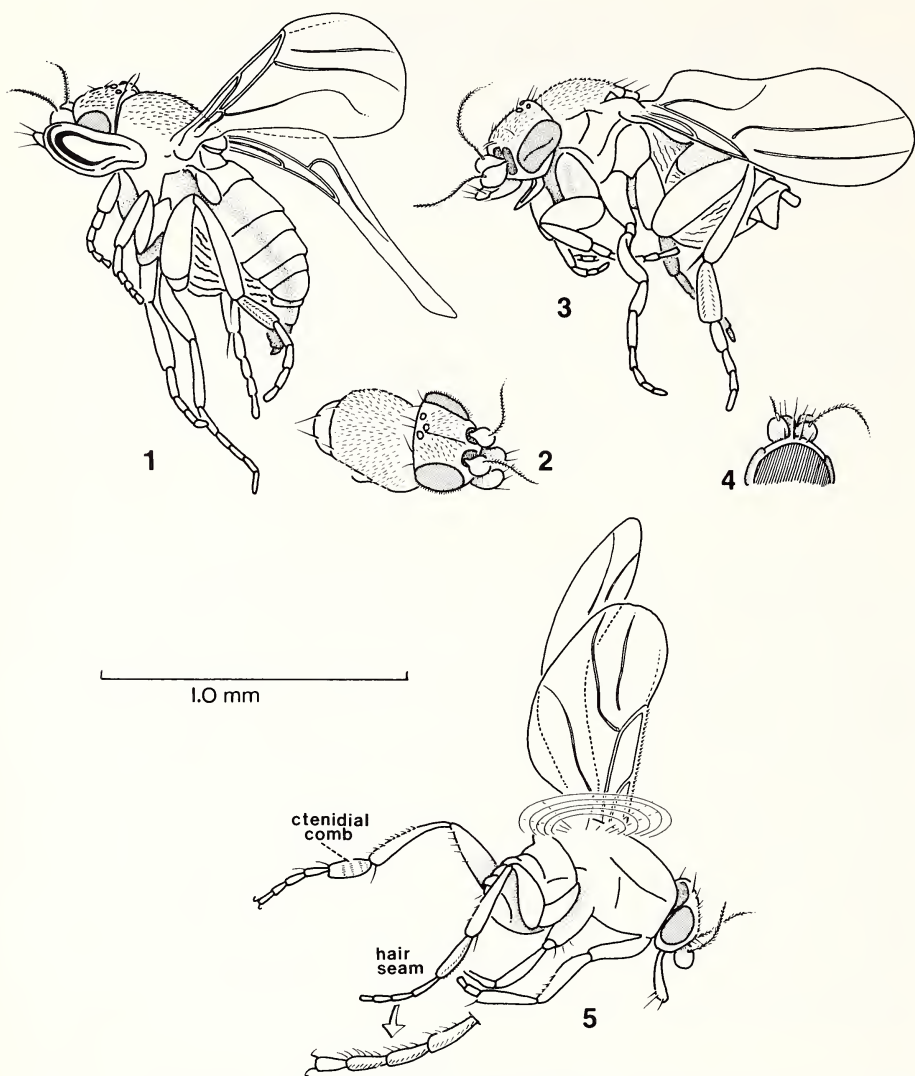
Methods used in studying the amber are given in Grimaldi (1987). References to geological ages of the various amber deposits are given in the sections dealing with the various specimens.

THE TERTIARY AMBER SPECIMENS

Figs. 1-7

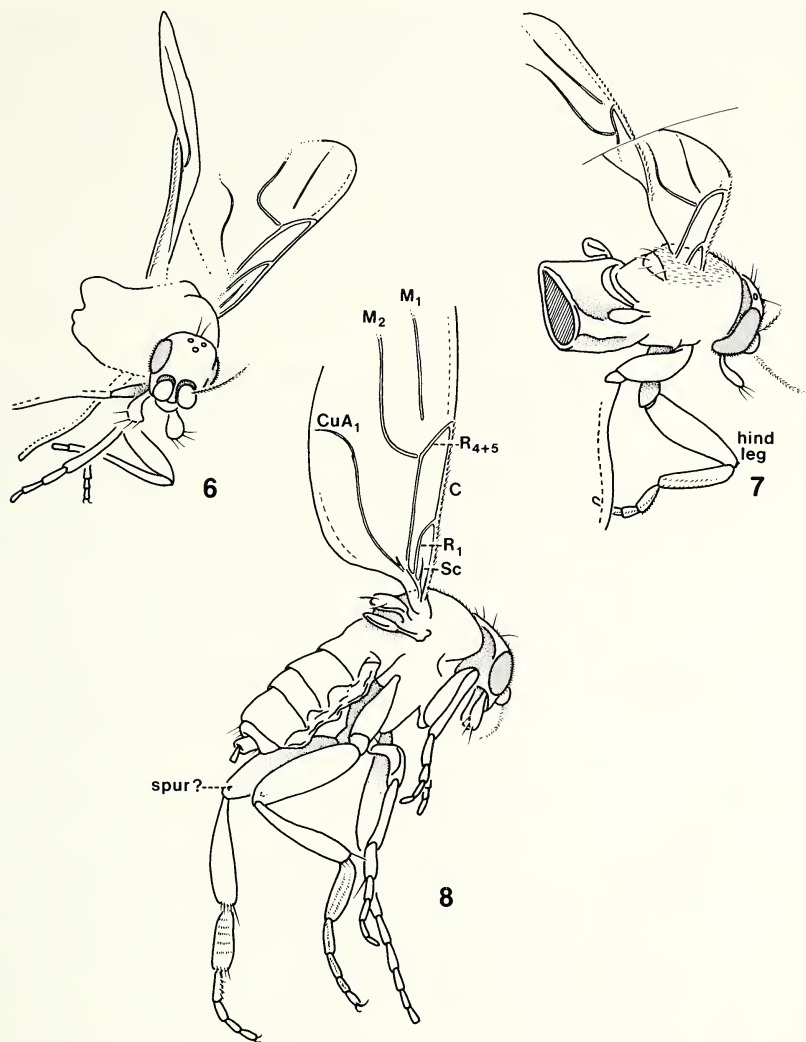
Five specimens of *Metopina* were found in Tertiary ambers, four from Chiapas, Mexico, and one from the Dominican Republic. The Mexican amber is considered to be late Oligocene by Hurd et al. (1962) and studies on the lower Miocene ages of at least some of the Dominican amber is briefly discussed in Grimaldi (1987). Detailed locality information is given under the account of each specimen. The five Tertiary specimens collectively have more features preserved than are seen in the Cretaceous specimen, but any species distinctions between the Chiapas and Dominican amber specimens have not been found.

Chiapas amber specimens: University of California (Berkeley) Museum of Pa-



Figs. 1-5. *Metopina* in amber from Chiapas, Mexico. 1, 2. UCMP B-7046-32, lateral view of habitus and oblique dorsal view of head and notum. 3. UCMP B-7048, lateral view. 4. Dorsal view of portion of head of UCMP B-7045-58, showing the supra-antennal setae and the pair of setae that flank them (the dorsal portion of the head and thorax of this specimen were missing). 5. AMNH Ch47, lateral view. Figures 1 through 8 are to the same scale.

leontology (UCMP) nos. B-7046-32, B-7045-58, B-7048, and American Museum of Natural History no. AMNH Ch47. All are from the mines near Simojoval, Chiapas State, the deposits of which are discussed in Hurd et al. (1962). Well-preserved, taxonomically important features are the following.



Figs. 6–8. *Metopina* in amber from the Dominican Republic and the late Cretaceous of New Jersey. 6, 7. AMNH 11848B, from the Dominican Republic, frontal and oblique lateral views. 8. *Metopina goeleti*, n. sp., holotype (AMNH C88720), from New Jersey. Lateral view, with most of the venation labeled.

Dorsal portion of the head, and the notum, halter, and abdominal tergites are darkest portions of the body.

Head: eyes higher than long; front broad and with numerous fine interfrontal setulae (cf. Figs. 13, 14); apparent on at least UCMP B-7048 is a pair of parallel supra-antennal bristles, lying on the dorsal margin of the ptilinal suture (cf. Figs. 13, 14), and in UCMP B-7045-58 a pair of slightly divergent bristles flank this pair (this

feature is more obvious in this specimen, because of the orientation); apparent in UCMP B-7048 and B-7046-32 is a pair of inclinate (convergent) orbitals (the anterior fronto-orbital bristles in Figs. 13 and 14), at about the middle of the front and slightly lateral to the supra-antennal bristles; postocellar setae parallel or subparallel, flanked by a pair of inclinate inner verticals and a pair of laterocline (divergent) outer verticals; flagellomere 1 spherical, and the arista (flagellomeres 2-4) is $2\frac{1}{2}$ to 3 times the length of fl-1; deep cavities of smooth contour house the pedicels (cf. Fig. 13) and are separated by a very thin carina (seen in B-7048); palp is longer than the pedicel, with 3 strong, straight setae at or near the apex; proboscis, seen in UCMP B-7048, thin, projected anteriorly. Specimen 7046-32 possesses a median furrow along the length of frons (cf. Figs. 13, 14) (this feature is obscure in the other specimens, if present).

Thorax: notum evenly covered with fine, short setulae; fore coxa of B-7048 as wide as fore femur and slightly concave; hind tibia with an apical seta, length about equal to width of tibia; lateral surface of hind tarsomere 1 with 2 hair seams (cf., Fig. 12); in B-7048 and AMNH Ch47 hind tarsomere 1 slightly wider than the tibia, but not so in the other Chiapas specimens; mesal surface of hind tarsomere with 5 rows of ctenidial combs (cf. Fig. 10); lateral surfaces of hind tarsomeres 2-4 with a single hair seam each extended along most of their lengths; wing with arcuate M_2 and CuA_1 veins (veins M_{3+4} and A_1 , respectively, in Disney [1985]; and veins 5 and 6, respectively, of other papers by Disney), but not as strongly curved as in the Cretaceous species; no evidence of a small fork at the apex of vein R_{4+5} ; M_2 and R_{4+5} separated by a very small gap; scutellum with a pair of apical, convergent setae; pair of slightly convergent prescutellar setae on posterior margin of notum and slightly lateral to scutellars (not all scutellars are presented in the illustrations, as they were not apparent on all of the specimens).

Abdomen: details of the terminalia are not apparent, but UCMP B-7046-32 can be identified as a female and B-7048 as a male. The female lacks the distinctive flap on tergite 5 (Fig. 9).

Dominican amber specimen: AMNH 11848, from mines in the vicinity of Santiago, Santiago Province. The distal portion of the abdomen of this specimen is missing, and some other portions of the body are obscured by conchoidal fractures. Although a fully frontal view of the head is available, the orbital setae are so fine in *Metopina* that they are virtually invisible in this specimen. Only the long, stout palpal setae and the pair of nearly parallel postocellars are apparent on the head. Veins M_2 and CuA_1 are arcuate, the former slightly more so than in the Chiapas specimens (but not as strongly as in the Cretaceous specimen), and the latter vein with about as much curvature as in the Chiapas specimens.

***Metopina goeleti*, new species**

Fig. 8

Diagnosis. The most distinctive features are in the wing venation: apical portion of R_{4+5} , distal to M_2 , is straight and meets the costal vein at about a 45° angle; M_2 strongly arcuate, its main axis almost parallel to the main axis of R_{4+5} ; CuA_1 very strongly arcuate, the distal portion at nearly a right angle to middle portion of this vein.

Description. The right side of the specimen shows the best view with most of the

wings and legs intact and their detailed features visible. Some clearing of the specimen has occurred, but the darkest (most melanized) portions are the notum, scutellum, tergites, and halter knob. Apparently the legs, pleura, and palpi were light yellowish. Although there is only an oblique lateral view of the head, visible are 2 straight, parallel postocellars flanked by divergent vertical setae, and 3 straight, stout setae on the apex of the palp. No long setae were seen on any segments of the forelegs. Midtarsomere 1 with a terminal seta on ventral surface. Hind leg with coxa about one-half the length of the femur, femur nearly twice as wide as tibia and about as long; combined lengths of tarsomeres slightly longer than length of the tibia. Relative lengths of hind tarsomeres: tarsomere 1 > 2=3 > 4=5. Mesal surface of hind femur with small, heavily sclerotized tubercle or spine near distal margin, which is apparently the same structure as that shown in Fig. 11 for *M. oligoneura*. Apex of hind tibia with 5 setae of lengths one-half to full width of tibia, the seta in the most ventral/anterior position being longest. Lateral surface of hind tarsomere 1 with 2 hair seams along the middle for most of length of segment, 5 rows of ctenidia on the mesal surface, and 4 setae at apex, of lengths approximately equal to those on tibia. Mesal surface of hind tarsomere 2 with 4 short, stout setae that project anteriad. Lateral surfaces of hind tarsomeres 2, 3, and 4 each with a single hair seam along most of their lengths. Wing venation distinctive, as described in the diagnosis.

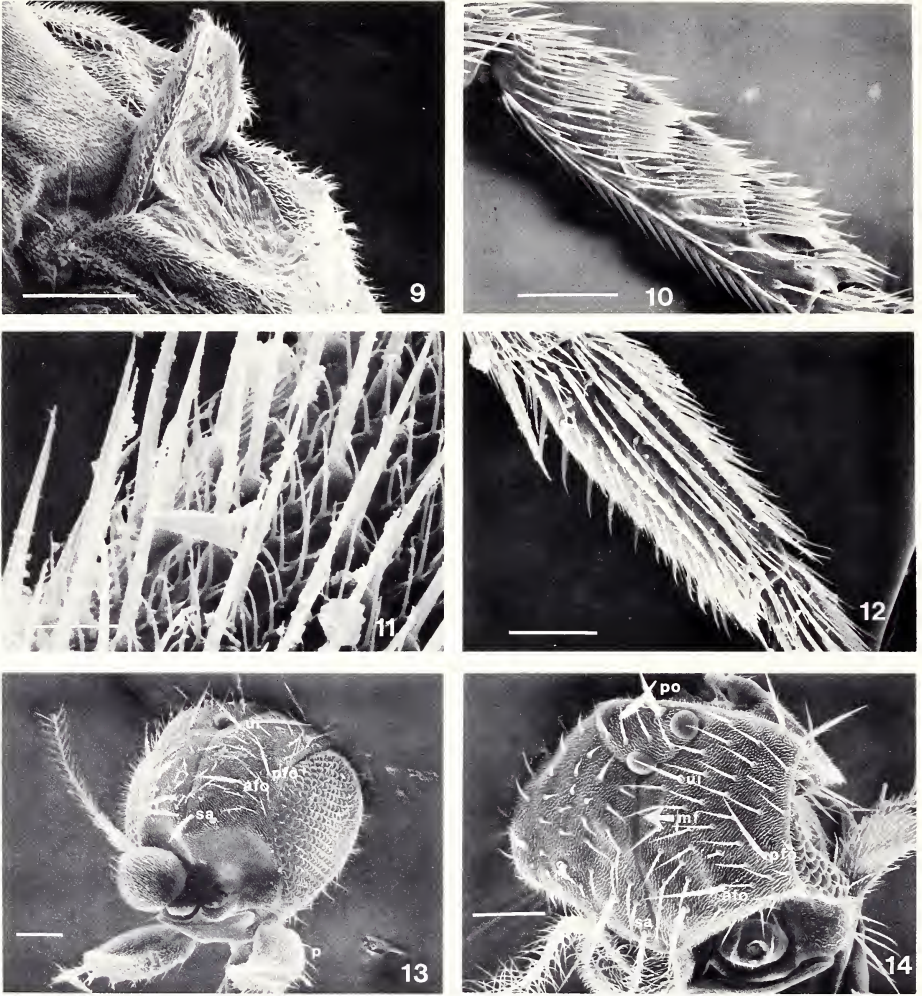
Holotype. Female, in amber piece AMNH C88720, from upper Cretaceous of New Jersey, found at Kinkora, New Jersey by Alfred C. Hawkins. In the amber collection of the American Museum of Natural History. The date of collection and exact stratigraphic position is unknown, but as discussed in Michener and Grimaldi (1988) and in Grimaldi et al. (1989), this deposit is probably from the upper Magothy Formation, or about 80 million years old.

Etymology. Named for Mr. Robert Goellet, former president of the American Museum, whose generosity made this and other studies of amber possible.

Discussion. This is the oldest known Phoridae, sensu stricto. The previously oldest known specimens, disregarding the Sciadoceridae, are from Baltic amber. Because the source deposits for most of the Baltic material have not yet been discovered, it is presumed to range in age between the upper Eocene and lower Oligocene. One sciadocerid and a phorid are known from the Canadian Cretaceous amber, of an age approximately 72 million years old (McAlpine and Martin, 1966), which accords with dating based on the austral distribution of the living representatives. While I agree with Hennig (1973) that *Prioriphora canadambra* McAlpine and Martin should be placed in the Phoridae, *Sciadophora bostoni* McAlpine and Martin certainly should not. *Prioriphora canadambra* has the thickened, dark, radial veins which are greatly shortened like the costal vein, with unbranched M_1 , M_2 , and M_3 veins that are nearly parallel, as is diagnostic for most of the Phoridae. *Sciadophora bostoni* venation is plesiomorphic with respect to phorid venation at the family level in virtually every respect: veins C and R_{4+5} reach nearly to the apex of the wing, the stem and fork of M_1 and M_2 is retained, and vein M_{3+4} originates at a distinctive basal-medial cell.

CONCLUSIONS

The genus *Metopina* presently consists of 33 species, 31 of them being described. The other two, undescribed species, are from Malaysia and Sulawesi (R. H. L. Disney, pers. comm.). The most recently described species is *Metopina ciceri*, the only known



Figs. 9–14. Scanning electron micrographs of various features of living *Metopina*. 9. Flap on tergite 5 of female *M. oligoneura*. 10. Ctenidial comb, on mesal surface of hind tibia, *M. recurvata*. 11. Spur on mesal surface of hind femur, *M. oligoneura*. 12. Hair seams, lateral surface of hind tibia, *M. oligoneura*. 13. Head of critical point-dried male of *M. oligoneura*. 14. Frontal surface of head of air-dried female of *M. recurvata* (eyes are collapsed). afo, anterior fronto-orbital seta; mf, median furrow; pfo, posterior fronto-orbital seta; p, palp; po, postocellar seta; sa, supra-antennal seta; ui, upper interfrontal seta. Scales are 40 μm , except Figure 11, which is 10 μm .

member of the genus from Asia (Disney, 1988). The New World tropics is apparently the most diverse area for this genus. There are 7 species from South America, 3 from Central America, and two from the Caribbean. The two Caribbean species are *Metopina reflexa* (from Puerto Rico) and *M. recurvata* (from Dominica). No species are

as yet known from the Dominican Republic, but this may just as well reflect little collecting effort there as it may a lack of the genus on Hispaniola. The only North American species is *M. subarcuata*, ranging from Idaho to Canada. In the only other paper treating Oligomiocene amber phorids (Disney, 1987), the taxa treated were a species of *Dohrniphora* and 3 species of *Megaselia* in Dominican amber.

Given the minute size of *Metopina* specimens, the amber specimens could not be examined for genitalic features, number of palpal segments, the presence of bifid tibial/tarsal comb hairs (Disney, 1983), and various aspects of chaetotaxy. Access to such characters would be necessary in order to accurately place the fossil species among the extant ones. The fossils possess a combination of features indicating their placement in the genus *Metopina*, as well as having some features plesiomorphic with respect to at least some *Metopina*. One of these plesiomorphic features is the absence of a flap-like abdominal tergite 5 in the females (Fig. 9). This flap was interpreted by Borgmeier (1963) as the basal portion of tergite 5, with tergites 5 and 6 being fused, although this latter interpretation is not what Disney (1986) concludes. Given this plesiomorphic feature it might be reasonable to name a new subgenus or genus for these amber specimens.

In a transformation series towards reduction in the length and ultimately the number of radial veins, it must be assumed that absence of the small vein R_{2+3} is a loss, and therefore apomorphic with respect to those taxa (most other metopinine and non-metopinine phorids) that possess the full complement of venation. The presence of at least two Phoridae in the late Cretaceous, one of which is apparently of a recently-derived group (*Metopina*), strongly suggests the family to be older than the fossils. Speculations on such ages should await detailed phylogenetic and biogeographic studies, in conjunction with the discovery of new fossils from various Cretaceous ambers. Other than *Prioriphora canadambra*, no other phorids are known from the Cretaceous ambers (McAlpine and Martin, 1969; Schlee and Dietrich, 1970).

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